

NTB125N02R, NTP125N02R

Power MOSFET 125 A, 24 V N-Channel TO-220, D²PAK

Features

- Planar HD3e Process for Fast Switching Performance
- Body Diode for Low t_{rr} and Q_{rr} and Optimized for Synchronous Operation
- Low C_{iss} to Minimize Driver Loss
- Optimized Q_{gd} and $R_{DS(on)}$ for Shoot-through Protection
- Low Gate Charge

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ Unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	24	V_{dc}
Gate-to-Source Voltage – Continuous	V_{GS}	± 20	V_{dc}
Thermal Resistance – Junction-to-Case Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$R_{\theta JC}$ P_D	1.1 113.6	$^\circ\text{C/W}$ W
Drain Current – Continuous @ $T_C = 25^\circ\text{C}$, Chip	I_D	125	A
Continuous @ $T_C = 25^\circ\text{C}$, Limited by Package	I_D	120.5	A
Continuous @ $T_A = 25^\circ\text{C}$, Limited by Wires	I_D	95	A
Single Pulse ($t_p = 10 \mu\text{s}$)	I_D	250	A
Thermal Resistance – Junction-to-Ambient (Note 1) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ P_D	46 2.72	$^\circ\text{C/W}$ W
Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	I_D	18.6	A
Thermal Resistance – Junction-to-Ambient (Note 2) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ P_D	63 1.98	$^\circ\text{C/W}$ W
Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	I_D	15.9	A
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = 50 V_{dc}$, $V_{GS} = 10 V_{dc}$, $I_L = 15.5 A_{pk}$, $L = 1 \text{ mH}$, $R_G = 25 \Omega$)	E_{AS}	120	mJ
Maximum Lead Temperature for Soldering Purposes, 1/8" from Case for 10 Seconds	T_L	260	$^\circ\text{C}$

1. When surface mounted to an FR4 board using 1 inch pad size, (Cu Area 1.127 in²).
2. When surface mounted to an FR4 board using minimum recommended pad size, (Cu Area 0.412 in²).

PIN ASSIGNMENT

PIN	FUNCTION
1	Gate
2	Drain
3	Source
4	Drain

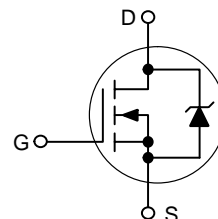


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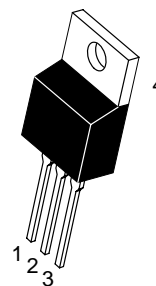
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125 AMPERES, 24 VOLTS

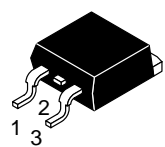
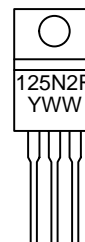
$R_{DS(on)} = 3.7 \text{ m}\Omega$ (Typ)



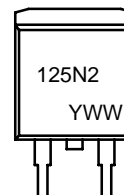
MARKING DIAGRAMS



TO-220AB
CASE 221A
STYLE 5



D²PAK
CASE 418AA
STYLE 2



125N2 = Specific Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
NTB125N02R	D ² PAK	50 Units/Rail
NTB125N02RT4	D ² PAK	800/Tape & Reel
NTP125N02R	TO-220AB	50 Units/Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

NTB125N02R, NTP125N02R

ELECTRICAL CHARACTERISTICS (T_J = 25°C Unless otherwise specified)

Characteristics	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (Note 3) (V _{GS} = 0 V _{dc} , I _D = 250 μA _{dc}) Temperature Coefficient (Positive)	V _{(BR)DSS}	25 –	28 15	– –	V _{dc} mV/°C
Zero Gate Voltage Drain Current (V _{DS} = 20 V _{dc} , V _{GS} = 0 V _{dc}) (V _{DS} = 20 V _{dc} , V _{GS} = 0 V _{dc} , T _J = 125°C)	I _{DSS}	– –	– –	1.5 10	μA _{dc}
Gate-Body Leakage Current (V _{GS} = ±20 V _{dc} , V _{DS} = 0 V _{dc})	I _{GSS}	–	–	±100	nA _{dc}

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage (Note 3) (V _{DS} = V _{GS} , I _D = 250 μA _{dc}) Threshold Temperature Coefficient (Negative)	V _{GS(th)}	1.0 –	1.5 5.0	2.0 –	V _{dc} mV/°C
Static Drain-to-Source On-Resistance (Note 3) (V _{GS} = 10 V _{dc} , I _D = 110 A _{dc}) (V _{GS} = 4.5 V _{dc} , I _D = 55 A _{dc}) (V _{GS} = 10 V _{dc} , I _D = 20 A _{dc}) (V _{GS} = 4.5 V _{dc} , I _D = 20 A _{dc})	R _{DS(on)}	– – – –	3.7 4.9 3.7 4.7	– – 4.6 6.2	mΩ
Forward Transconductance (Note 3) (V _{DS} = 10 V _{dc} , I _D = 15 A _{dc})	g _{FS}	–	44	–	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{DS} = 20 V _{dc} , V _{GS} = 0 V, f = 1 MHz)	C _{iss}	–	2710	3440	pF
Output Capacitance		C _{oss}	–	1105	1670	
Transfer Capacitance		C _{rss}	–	227	640	

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	(V _{GS} = 10 V _{dc} , V _{DD} = 10 V _{dc} , I _D = 40 A _{dc} , R _G = 3 Ω)	t _{d(on)}	–	11	22	ns
Rise Time		t _r	–	39	80	
Turn-Off Delay Time		t _{d(off)}	–	27	40	
Fall Time		t _f	–	21	40	
Gate Charge	(V _{GS} = 4.5 V _{dc} , I _D = 40 A _{dc} , V _{DS} = 10 V _{dc}) (Note 3)	Q _T	–	23.6	28	nC
		Q ₁	–	5.1	–	
		Q ₂	–	11	–	

SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	(I _S = 20 A _{dc} , V _{GS} = 0 V _{dc}) (Note 3) (I _S = 55 A _{dc} , V _{GS} = 0 V _{dc}) (I _S = 20 A _{dc} , V _{GS} = 0 V _{dc} , T _J = 125°C)	V _{SD}	– – –	0.82 0.99 0.65	1.2 – –	V _{dc}
Reverse Recovery Time	(I _S = 30 A _{dc} , V _{GS} = 0 V _{dc} , dI _S /dt = 100 A/μs) (Note 3)	t _{rr}	–	36.5	–	ns
		t _a	–	17.7	–	
		t _b	–	18.8	–	
Reverse Recovery Stored Charge		Q _{RR}	–	0.024	–	μC

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

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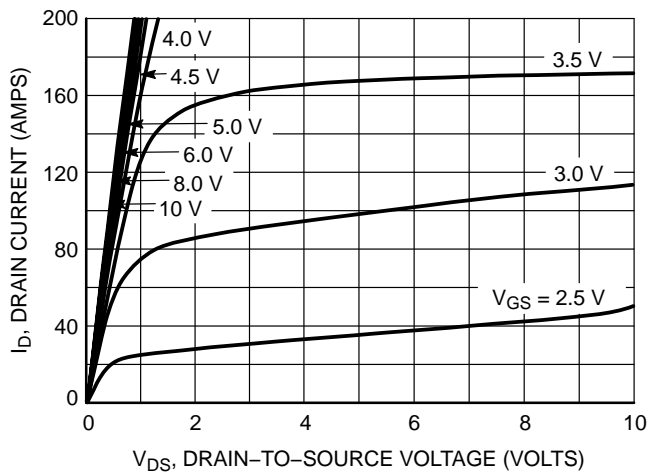


Figure 1. On-Region Characteristics

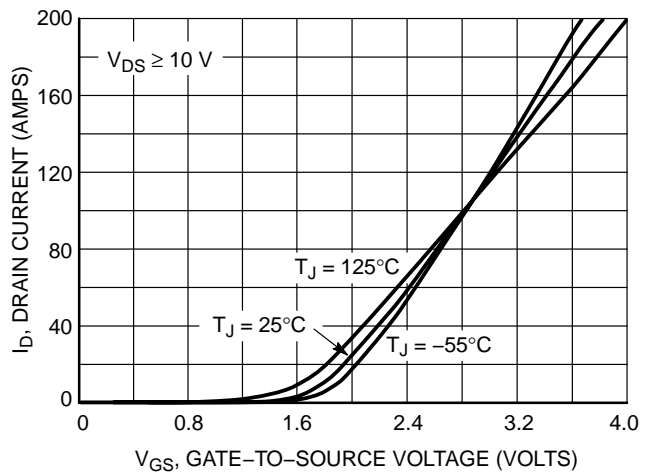


Figure 2. Transfer Characteristics

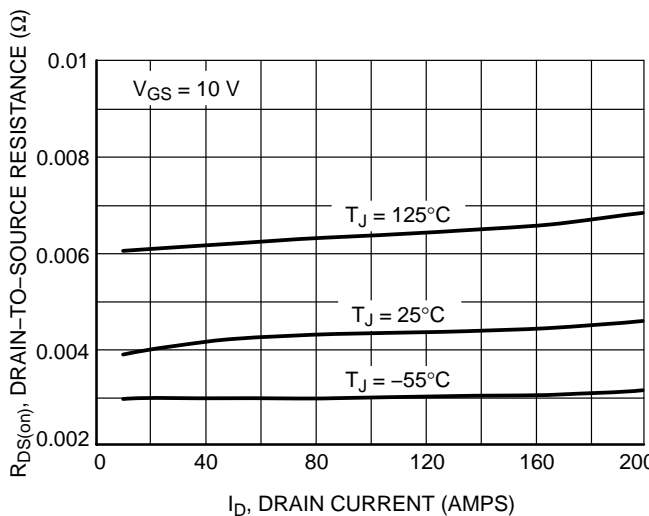


Figure 3. On-Resistance versus Drain Current and Temperature

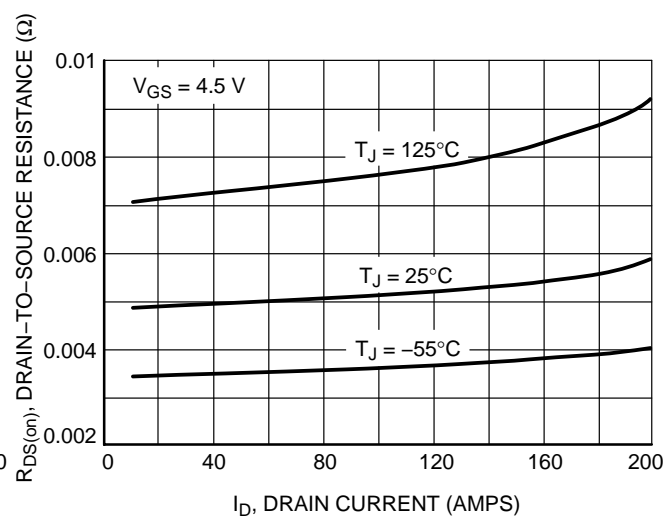


Figure 4. On-Resistance versus Drain Current and Temperature

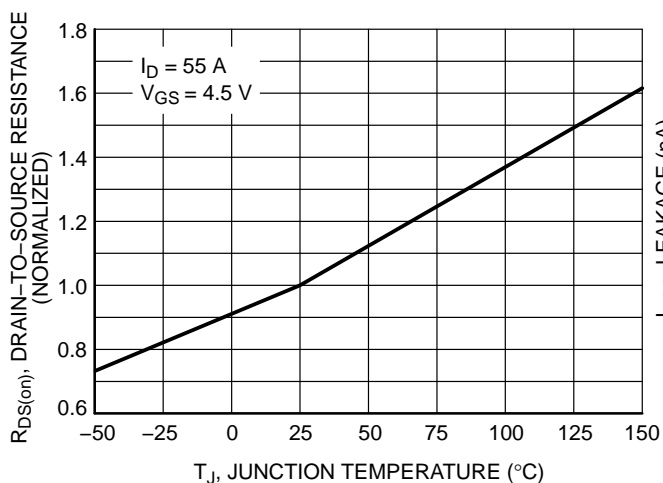


Figure 5. On-Resistance Variation with Temperature

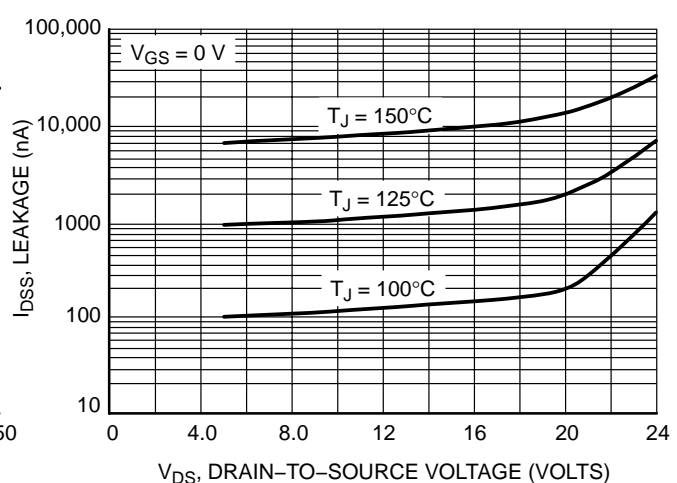


Figure 6. Drain-to-Source Leakage Current versus Voltage

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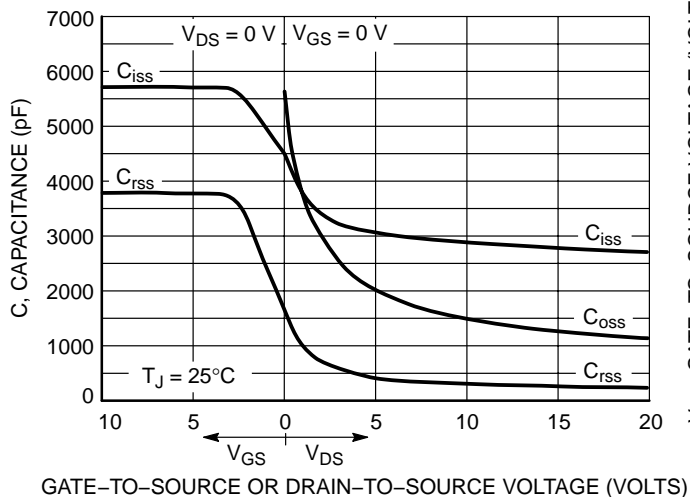


Figure 7. Capacitance Variation

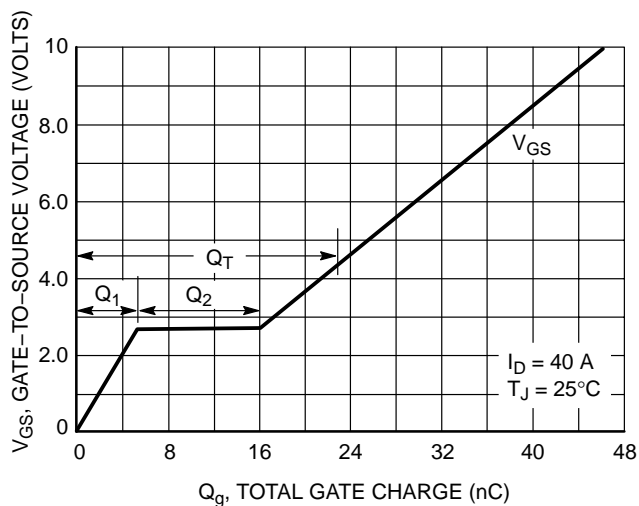


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

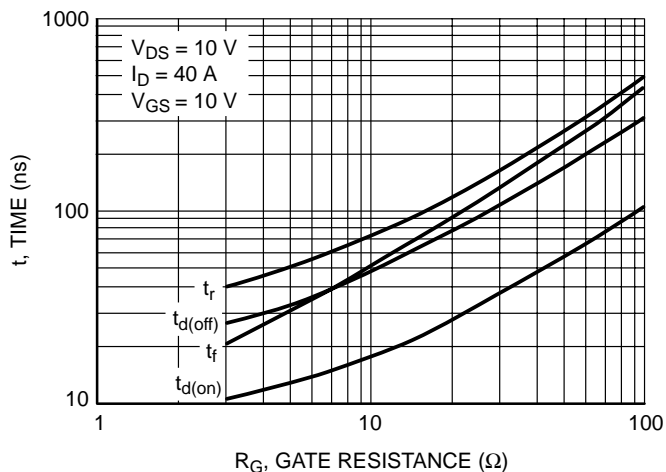


Figure 9. Resistive Switching Time Variation versus Gate Resistance

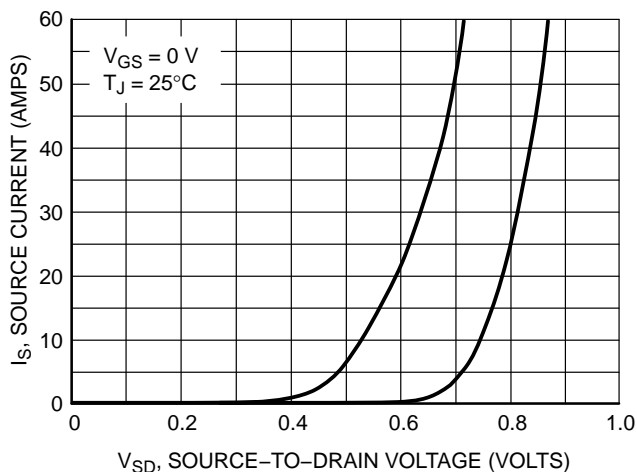


Figure 10. Diode Forward Voltage versus Current

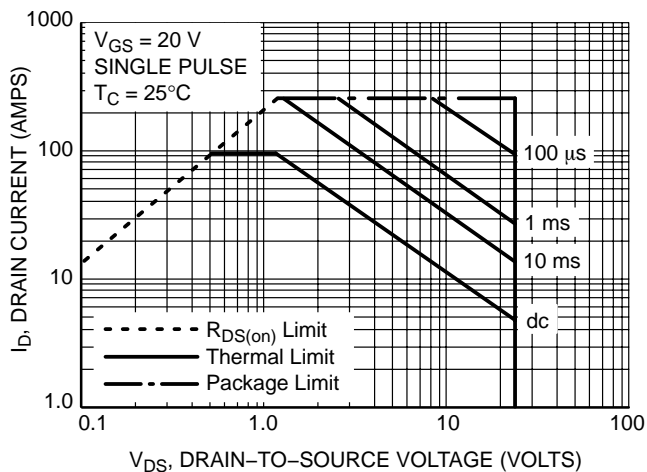


Figure 11. Maximum Rated Forward Biased Safe Operating Area

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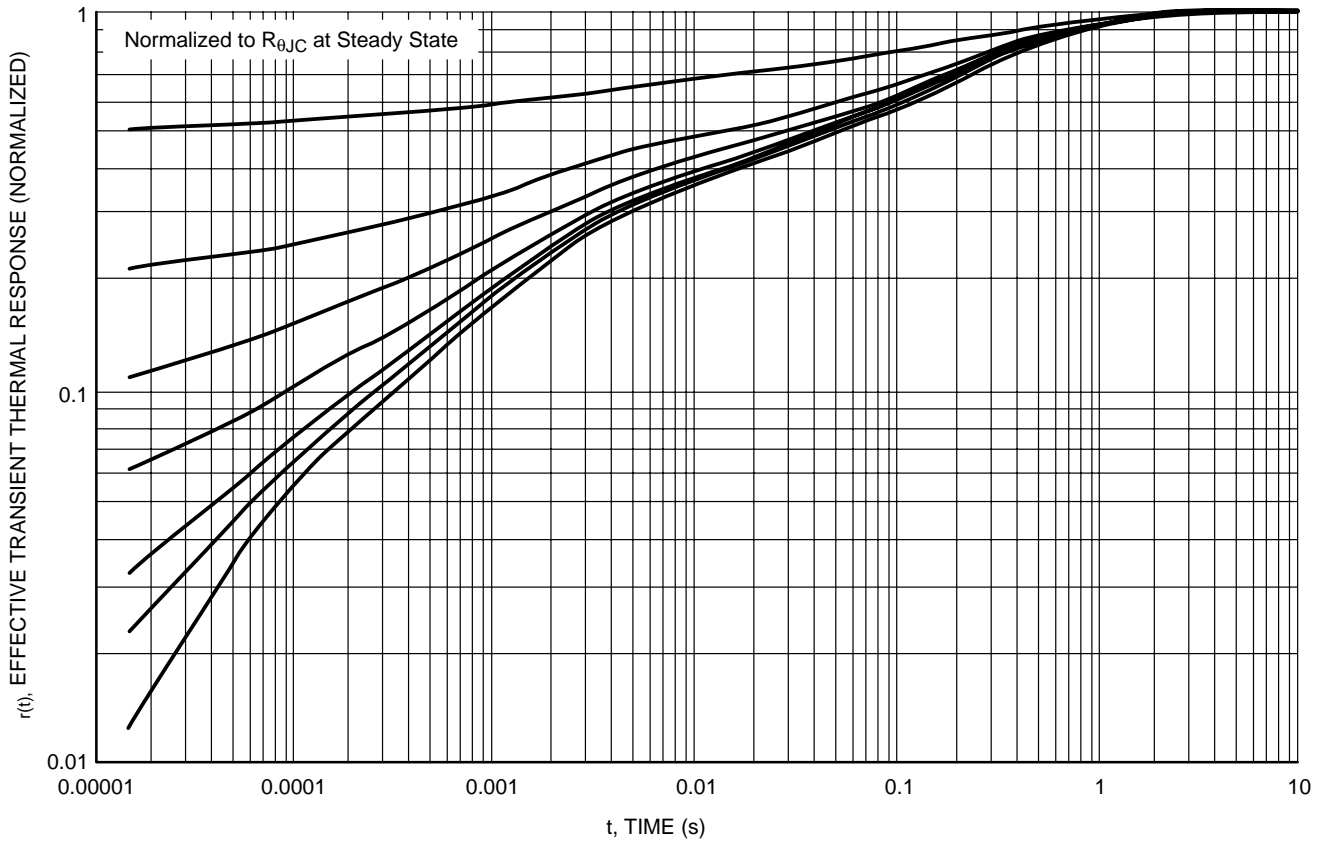
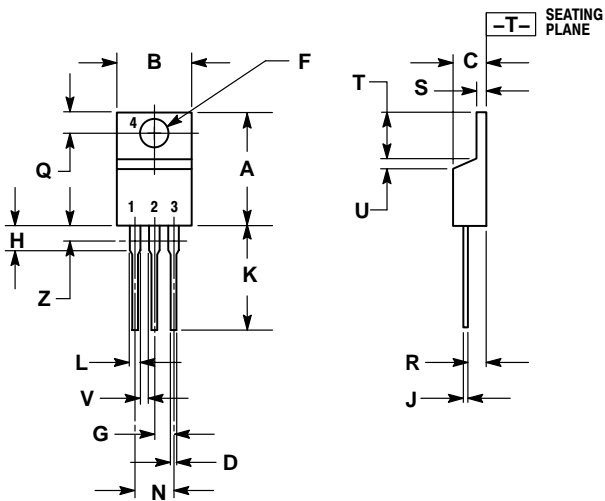


Figure 12. Thermal Response

PACKAGE DIMENSIONS

TO-220AB CASE 221A-09 ISSUE AA



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

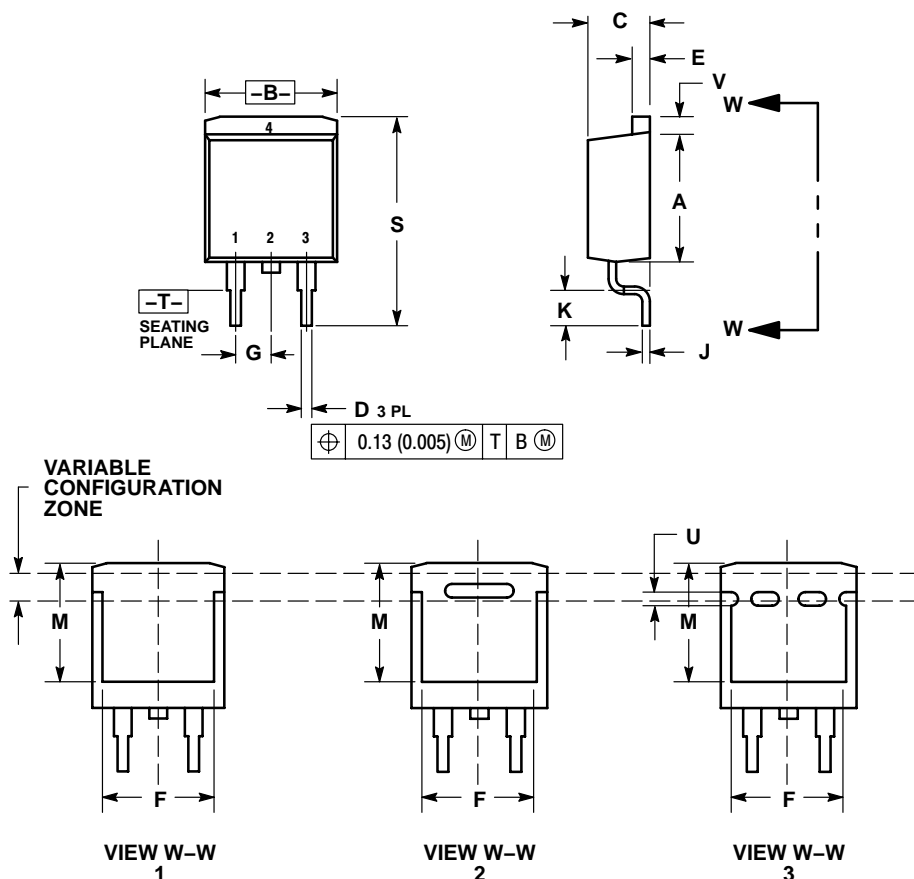
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

- STYLE 5:
- PIN 1. GATE
 - DRAIN
 - SOURCE
 - DRAIN

NTB125N02R, NTP125N02R

PACKAGE DIMENSIONS

D²PAK
CASE 418AA-01
ISSUE O



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.036	0.51	0.92
E	0.045	0.055	1.14	1.40
F	0.310	---	7.87	---
G	0.100 BSC	---	2.54 BSC	---
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
M	0.280	---	7.11	---
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

STYLE 2:

- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

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